

MALARIA ON A VENEZUELAN OILFIELD

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PLATES XXIII AND XXIV

The oilfield is situated on the eastern side of Lake Maracaibo, Venezuela, about 80 miles from the head of the lake, and 10 miles inland from its shores. The following observations were made in the month of August, 1921.

MALARIA IN THE NATIVE POPULATION

The extent to which malaria prevailed in the native population of various villages in the district is shown in the following table:—

Age Period	0—10		11—20		21—	
	No. exam.	Percentage infected	No. exam.	Percentage infected	No. exam.	Percentage infected
Old Village	10	10	8	12·5	0	—
New Village	32	46·8	39	23·0	49	8·1
San Pedro	9	66·6	6	0·0	1	0·0
Los Barrosos	9	0·0	9	0·0	0	—
San Timoteo	27	3·7	4	0·0	0	—

The relationship of malaria in the Old Village and New Village respectively to malaria among the white employees on the oilfield we shall discuss later. The other three villages were not in the immediate neighbourhood of the oilfield, but it may be pointed out here that the absence of infection in Los Barrosos was probably due to the fact that anophelines were only found at a distance of half a mile, and then only in one small clay-pit about

12 feet square. San Timoteo is a village built on piles over Lake Maracaibo. Its low endemic index, 3.7 in children under ten, is thus probably due to its position over the lake and to the fact that only one small anopheline larva was found after prolonged search on the mainland. San Pedro is four or five miles from the oilfield, and its high rate is probably due to its being situated close to extensive anopheline swamps.

SPECIES OF PARASITES FOUND

In over two hundred blood specimens examined, malignant tertian malaria (crescents) was only found twice, simple tertian and quartan parasites were about equally common, a peculiarity of infection which I had not previously seen in Africa or India. The frequency with which pigmented leucocytes were observed in the 'positive' films was a noteworthy feature.

MALARIA AMONG THE WHITE STAFF

No precise information was forthcoming as to the nature of the sickness among the white employees (about thirty in number). An examination of the blood of sixteen employees in apparent good health revealed nothing. In the case of one employee suffering from fever, simple tertian parasites were found. In the absence of definite records, one had therefore to assume that the sickness prevalent among the staff was due to malaria.

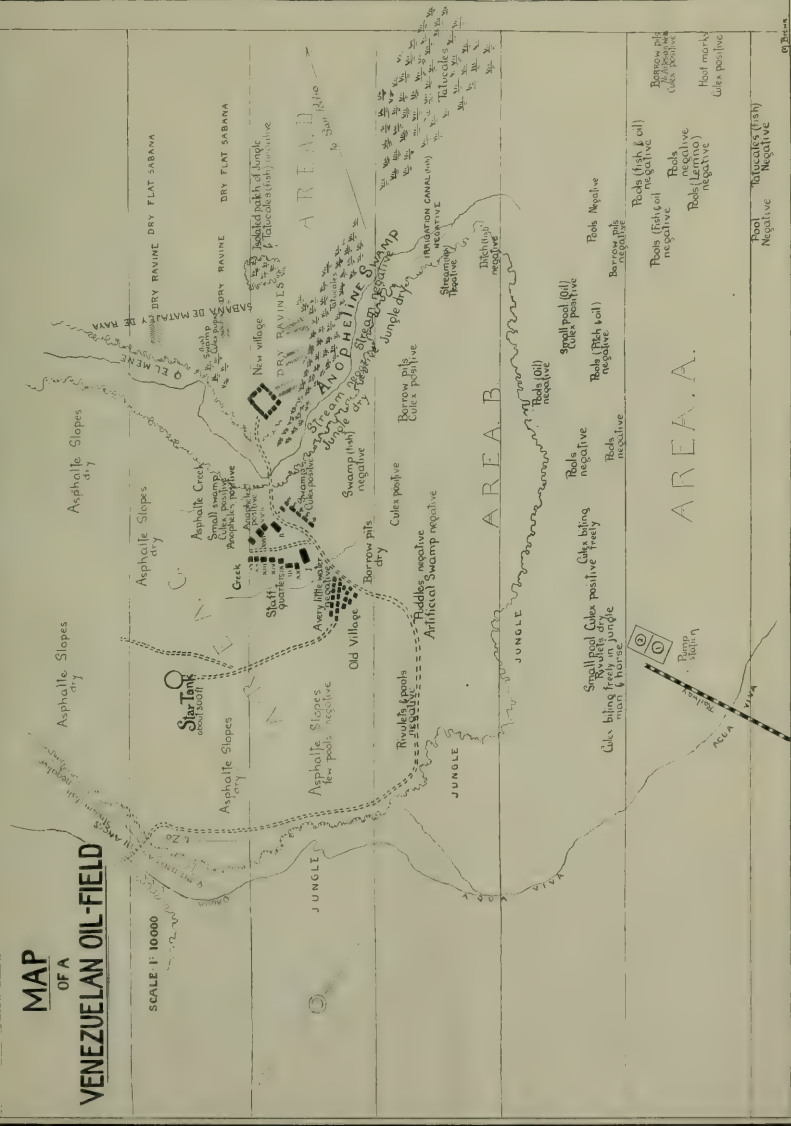
POSITION OF THE STAFF HOUSES

They are situated (*vide* Map), (1) on two ridges a few hundred yards from the first source of *Anopheles*, viz., the small anopheles swamp in the Asphalte creek, the houses on the easterly ridge actually overlooking the swamp. (2) From the second source of *Anopheles* the 'Anopheles Swamp' which begins due west and even north-west of the New Village, they are situated less than half a mile. (3) They are situated less than a quarter of a mile from a source of malaria infection, the Old Village, and (4) since the year 1920 half a mile from a second source of infection, the New Village.

We have here then an example of the conditions so frequently

MAP
OF A
VENEZUELAN OIL-FIELD

SCALE 1" = 10,000



67-2182

found in the tropics, namely, native villages and a source of *Anopheles* in close proximity to a white population, and here, as elsewhere, the conditions would completely explain the existence of malaria among the white employees.

THE ANOPHELINES

The district under investigation can be divided into four areas:—

- A. The Jungle.
- B. The cleared area.
- C. The residential and Old Village area.
- D. The New Village area.

The relative positions of these will be seen on the map.

AREA A. THE JUNGLE.

Numerous examinations were made of all discoverable water in the jungle so far as it was penetrable. In many cases, pools and streams and 'tatucales,'* apparently favourable breeding-places, were examined with negative result, often, no doubt, due to the presence of abundance of small fish (in some cases due to a covering of *Lemma* (duckweed). In other cases, however, jungle pools were 'Culex' positive.

One interesting example was encountered, viz., that of a borrow-pit, where the snouts of dozens of small fish could be seen voraciously hunting the surface for food, and yet 'Culex' larvae in abundance were found in the protecting weed and rubbish at the sides, but none away from there.

Again where the jungle was apparently dry over large areas, yet 'Culex' was present and bit freely in the daytime when one stood still.

Anopheles (mosquitoes or larva) was, then, absent from the jungle at least in August, and mosquitoes caught in the jungle at long distances from the oilfield were invariably 'Culex.'

AREA B. THE CLEARED AREA.

Here and there a few 'Culex' breeding-grounds were found, generally in small numbers. A swamp a hundred yards or so long,

* Tatucales: Diminutive islands or mounds intersected by water, and in which progress could only be made by a series of jumps.

passing in front of the native mechanics' quarters 1 to 6 and close to the next area, is of interest in that repeated search showed it to be *Anopheles* negative, but it contained a small '*Culex*' area near its origin. It had been already partly, but incompletely drained, and fish abounded.

AREA C. STAFF HOUSES AREA.

The Staff Houses are situated for the most part on two ridges themselves separated by a dry ravine. These ridges are bounded on the N.W. and N.E. by the Mene Grande and Asphalte creeks respectively. These creeks merge at their origin northwards, and are bounded by the slopes of the ridge on which the Star Water tank is situated. Again further north to the west and the east this ridge descends in sloping ground, dry for the most part and covered with asphalte until in a N.W. direction the creek '*Piedritas blancas*' is reached.

The whole of this large area is for the most part dry. What little water there is, is found in the slopes draining to the road from the Old Village to Zo, but frequent examinations of all collections of water in this area were negative. As regards the Asphalte creek itself, this was also negative except for a small swamp some fifty yards long in its upper portion. Here *Anopheles* larvae in scanty numbers were found. The rest of the creek had already been drained; the ditches contained numerous fish and considerable quantities of oil. The swamp above referred to was caused by a small depression in the surface, and was easily abolished by cutting the long grass and filling with earth from the adjacent higher ground.

AREA D.—OR NEW VILLAGE AREA.

The New Village is situated on the Sabana de Matajey de Raya on elevated ground (thirty metres) a hundred yards or more from the creek El Mene or water creek. From the elevated flat ground on which the village lies a number of dry ravines lead down to a swamp some fifty yards or so in width, bordering the stream formed by the junction of the streams from the Asphalte and El Mene creeks. This swamp extends along the edge of the Sabana in a curved course (probably as far as San Pedro), and was found to contain Anopheline larvae—always, it is true, scanty in number—for a distance of,

roughly, about three-quarters of a mile. Although fish were plentiful in the two drains that had already been cut in part of it, but which were blocked when examined by me, yet *Anopheles* were present always in small numbers, but from its extent this swamp and its tributary swamps (*vide infra*) formed the *main source of Anophelines*. The Tatucales, out in the Sabana, contained fish, and was negative.

The ravines below the village to which reference has been made, extend in a south-easterly direction, becoming less steep and with flatter bottoms so that they are no longer dry but are occupied by swamps; it is these secondary tributary swamps and the main swamp which they eventually join, which formed the great Anopheline breeding-ground.

In the four areas examined, *Anopheles* were found breeding in two only, and in one of these only in a swamp of small dimensions. The breeding-grounds were thus in August definitely restricted; *Anopheles* were not breeding in the jungle nor in the open cleared area, nor in the waters that existed on the asphalte slopes of Area C.

The swamp in which *Anopheles* were found breeding was overgrown with a variety of grasses, some up to 6 ft. high; in other parts it more resembled marshy ground with short rushes in part trodden by cattle; in other parts again 'tatucales' formation. In no case were *Anopheles* found amidst overhanging trees.

Anopheles (C. argyrotarsis) were also found breeding in one of half a dozen clay borrow-pits some three miles away from the camp.

ADULT ANOPHELINES.

The search for anophelines in the native huts in the daytime was completely fruitless, and culicines also were very scanty. This condition was in marked contrast to those observed by me in the neighbourhood of Lake Valencia, which I visited on my way home, where in the daytime, in the verandah of a hut, it was easy to collect numerous anophelines, embracing three different species. On the oilfield itself I was only able to secure by capture at night in the native village sixteen specimens of *C. argyrotarsis*, and during my stay in the camp no anophelines and very few culicines were seen by

me in the house I occupied. It should be stated that the windows of all the houses in the camp were wire-screened, and mosquito-nets were in general use.

PROPHYLAXIS

The existence of infection in the Old Village and the absence of *Anopheles* from any area nearer than an isolated small, grass-grown swamp in the Asphalte creek and the great Anopheline Swamp adjacent to the New Village proves, I think, that we have a normal flight range of about half a mile.

We may consider prophylactic measures under the following headings:—

(a) DRAINAGE OF ANOPHELINE SWAMP.

Towards the end of my visit, 100 yards or so had been cleared of grass and existing choked drains cleared and additional ones constructed, with the result that the swamp rapidly became dry and free from larvae in this section. I suggested that the swamp should be drained for about a mile. The efficacy of this measure can be estimated by observing the effect (1) on the number of anophelines caught in the New Village month by month; (2) on the endemic index of the New Village; (3) on the sickness rate of the white staff. If the drainage results in a complete or almost complete suppression of anophelines, further measures would hardly be necessary, but in the event of this not being so, other measures would have to be adopted.

(b) REMOVAL OF THE OLD VILLAGE.

This source of infection in close proximity to the white staff quarters should be abolished, and if further protection is sought various stray native huts which exist here and there should also be removed.

(c) THE NEW VILLAGE.

If drainage of the anopheline swamp is unsuccessful, it would be necessary to consider the question of removal of the New Village to an area free from anopheline breeding-places; such a one existing

a mile or so from its present position. For elimination of malaria from the village itself, quinine administration is advisable; and further, if it remains in its present position wire screening of the huts could be advantageously employed, without prohibitive cost.

(d) A more fundamental and expensive procedure would be the removal of the white staff houses. An ideal site for these exists on the Star Tank ridge, at an elevation of about 300 ft. and at a distance of about a mile from the New Village and Anopheline Swamp.

One sees, accordingly, that the existing conditions have arisen from a lack of appreciation of the fundamental principles responsible for the infection of the white man amidst a native population, namely, close propinquity to that population, with a supply of anophelines also adjacent. Had one been laying out the camp de novo, the following arrangement would, I believe, have led to the protection not only of the white but also of the native population:— (1) The white staff houses should have been placed on the Star Tank ridge; (2) the native village should have been placed a mile from this site and also a mile from the source of anophelines.

The conditions prevailing were particularly favourable for such an arrangement, namely, (1) the complete absence of anopheline breeding-grounds over a large part of the area considered, and (2) the large tract of ground in which collections of surface water of any sort were absent (in August).

NOTES

The oilfield was situated in Lat. $9^{\circ}.75'$ N. and Long. $71^{\circ}.15'$ W. The indoor temperatures in August ranged from 85° - 89.5° F. maxima to 75° - 81.5° F. minima. Heavy rain lasting about half an hour fell towards evening on five out of twenty days.

The only species of Anopheline found in the area was *Cellia argyrotarsis*, distinguished by having three and three-quarters hind tarsi almost completely white. The palmate hairs of the larva of this species are variable. Usually there are palmate hairs on segments two to seven, that on segment two being small and hard

to see. Examples were also found with well developed palmate hairs on segments one to seven, together with a well developed thoracic palmate hair.

Examinations of sixteen specimens of *C. argyrotarsis* for sporozoites proved negative, but Tovar states that this species transmits in Venezuela.

The small fish which abounded in the small streams and in the swamps of the district belonged to the following species:—

Gambusia (Poecilia) tridentigera,

Haplochilus sp., and

Chromides (Acara) dorsigera.

EXPLANATION OF PLATE XXIV

- Fig. 1. Old type of Bungalow.
- Fig. 2. Modern type of Bungalow.
- Fig. 3. The Peons' Cock-pit.
- Fig. 4. Bird's-eye view of Staff houses. The ridge with Star Water Tank in the distance.
- Fig. 5. The Asphalte slopes. The arrows point to two asphalte mounds.



FIG. 1



FIG. 2



FIG. 3



FIG. 4



FIG. 5